power levels between LEO systems may be able to assure that such beam coupling events are tolerable and do not result in loss of connections.

Another requirement issue is whether feeder link bands should be identified exclusively for LEO feeder links or whether operations of geostationary satellites and LEO feeder links in the same band are feasible and/or desirable. Ideally, non-geostationary satellite feeder link bands should be unused by geostationary satellites to avoid operational impact on non-geostationary satellite service due to RR 2613 obligations during periods of beam coupling.

4. Impact of Ka-band Feeder Links

The exclusive FSS Ka-bands (500 MHz uplink at 29.5-30.0 GHz and 500 MHz downlink at 19.7-20.2 GHz proposed by Motorola and TRW are addressed in Section 4.4 of Annex 3 to the NRM Final Report. In addition, the Commission is requiring LEO systems to consider use of the bands shared with terrestrial services at 27.5-29.5 GHz uplink and 17.7-19.7 GHz downlink in CC Docket No. 92-297 and a new NRM Committee is being organized to consider sharing between LEO feeder links at Ka-band and the local multipoint distribution service (LMDS).

Constellation's system architecture provides for gateway earth stations to be located in each country served by the Constellation system. Accordingly, Constellation's satellites must be able to provide access to multiple gateways distributed across the earth as seen from the satellite. At C-band, this coverage capability can be provided easily and at low cost by a simple earth coverage antenna on board the Constellation satellites. Moreover, at C-band the transmit power levels are relatively small and do not create demanding

Outbound Link Performance

Elevation Angle (°)	25	90
Range (km)	3368	2000
Uplink Frequency (MHz)	6558	6558
Transmit Power Per Carrier (watts)	0.2	0.2
Line Loss (dB)	0.5	0.5
TX Antenna Gain (dBi)	50.4	50.4
Transmit EIRP (dBW)	42.9	42.9
Misc. Uplink Losses (dB)	1.0	1.0
Path Loss (dB)	179.3	174.8
RX Antenna Gain (dBi)	3.0	3.0
Line Loss (dB)	0.5	0.5
RX Power Level (dBW)	-134.9	-130.4
Noise Density (dBW/Hz)	-202.6	-202.6
Uplink C/No (dB-Hz)	67.7	72.2
Downlink Frequency (MHz)	2492	2492
Power per carrier (dBW)	-3.9	-7.1
Line Loss (dB)	1.5	1.5
TX Antenna Gain (dBi)	15.9	14.6
Carrier EIRP (dBW)	10.5	6.0
Miscellaneous Downlink Losses (dB)	0.5	0.5
Path Loss (dB)	170.9	166.4
Power Flux Density (dBW/m^2-4kHz)	-142.0	-142.0
RX Antenna Gain (dBi)	3.0	3.5
Line Loss (dB)	0.5	0.5
RX Power Level (dBW)	-158.4	-157.9
Noise Density (dBW/Hz)	-203.5	-203.5
Downlink C/No (dB-Hz)	45.0	45.6
Code and Adj Beam Noise Factor (numerical)	0.21	0.21
Code Noise Density @ User (dBW/Hz)	-205.5	-205.0
Code Noise C/Io (dB-Hz)	53.9	53.9
Link C/No (dB-Hz)	44.5	45.0
Eb/No (dB)	7.5	8.0
Matched Filter Loss (dB)	1.0	1.0
Demodulator Implementation Loss (dB)	0.25	0.25
Required Eb/No (dB)	2.8	2.8
Margin (dB)	3.5	3.9

Inbound Link Performance

Elevation Angle (°)	25	90
Range (km)	3368	2000
Uplink Frequency (MHz)	1618	1618
Transmit Power Per Carrier (mw)	600.0	250.0
Line Loss (dB)	0.5	0.5
TX Antenna Gain (dBi)	3.0	3.5
Transmit EIRP (dBW)	0.3	-3.0
Misc. Uplink Losses (dB)	0.5	0.5
Path Loss (dB)	167.2	162.7
RX Antenna Gain (dBi)	15.5	14.6
Line Loss (dB)	1.0	1.0
RX Power Level (dBW)	-152.9	-152.6
Noise Density (dBW/Hz)	-202.6	-202.6
Uplink C/No (dB-Hz)	49.7	50.0
Downlink Frequency (MHz)	5183	5183
Power Per Carrier (dBW)	-16.5	-16.5
Line Loss (dB)	0.5	0.5
TX Antenna Gain (dBi)	3.0	3.0
EIRP Per Carrier (dBW)	-14.0	-14.0
Miscellaneous Downlink Losses (dB)	1.0	1.0
Path Loss (dB)	177.3	172.8
Power Flux Density (dBW/m^2-4kHz)	-166.5	-161.9
RX Antenna Gain (dBi)	48.4	48.4
Line Loss (dB)	0.5	0.5
RX Power Level (dBW)	-144.3	-139.8
Noise Density (dBW/Hz)	-204.1	-204.1
Downlink C/No (dB-Hz)	59.7	64.2
Code and Adj Beam Noise Factor (numerical)	1.21	1.21
Code Noise Density @ Satellite (dBW/Hz)	-200.0	-199.6
Code Noise C/Io (dB-Hz)	46.2	46.2
Link C/No (dB-Hz)	44.5	44.7
Eb/No (dB)	7.5	7.7
Matched Filter Loss (dB)	1.0	1.0
Demodulator Implementation Loss (dB)	0.25	0.25
Required Eb/No (dB)	2.8	2.8
Margin (dB)	3.5	3.6

Table C-2. Baseline 2.56 MHz Bandwidth Constellation Link Budget

Outbound Link Performance

Elevation Angle (°)	25	90
Range (km)	3368	2000
Uplink Frequency (MHz)	6558	6558
Transmit Power Per Carrier (watts)	0.2	0.2
Line Loss (dB)	0.5	0.5
TX Antenna Gain (dBi)	50.4	50.4
Transmit EIRP (dBW)	42.9	42.9
Misc. Uplink Losses (dB)	1.0	1.0
Path Loss (dB)	179.3	174.8
RX Antenna Gain (dBi)	3.0	3.0
Line Loss (dB)	0.5	0.5
RX Power Level (dBW)	-134.9	-130.4
Noise Density (dBW/Hz)	-202.6	-202.6
Uplink C/No (dB-Hz)	67.7	72.2
Downlink Frequency (MHz)	2492	2492
Power per carrier (dBW)	-3.9	-7.1
Line Loss (dB)	1.5	1.5
TX Antenna Gain (dBi)	15.9	14.6
Carrier EIRP (dBW)	10.5	6.0
Miscellaneous Downlink Losses (dB)	0.5	0.5
Path Loss (dB)	170.9	166.4
Power Flux Density (dBW/m^2-4kHz)	-142.0	-142.0
RX Antenna Gain (dBi)	3.0	3.5
Line Loss (dB)	0.5	0.5
RX Power Level (dBW)	-158.4	-157.9
Noise Density (dBW/Hz)	-203.5	-203.5
Downlink C/No (dB-Hz)	45.0	45.6
Code and Adj Beam Noise Factor (numerical)	0.21	0.21
Code Noise Density @ User (dBW/Hz)	-205.5	-205.0
Code Noise C/Io (dB-Hz)	53.9	53.9
Interfering Feeder Link Received Power	-117.9	-113.4
Code Noise Density @ User (dBW/Hz)	-181.9	-177.4
Code Noise C/Io (dB-Hz)	47.0	47.0
Link C/No (dB-Hz)	42.6	42.9
Eb/No (dB)	5.6	5.9
Matched Filter Loss (dB)	1.0	1.0
Demodulator Implementation Loss (dB)	0.25	0.25
Required Eb/No (dB)	2.8	2.8
Margin (dB)	1.5	1.8

Inbound Link Performance

Elevation Angle (°)	25	90
Range (km)	3368	2000
Uplink Frequency (MHz)	1618	1618
Transmit Power Per Carrier (mw)	600.0	250.0
Line Loss (dB)	0.5	0.5
TX Antenna Gain (dBi)	3.0	3.5
Transmit EIRP (dBW)	0.3	-3.0
Misc. Uplink Losses (dB)	0.5	0.5
Path Loss (dB)	167.2	162.7
RX Antenna Gain (dBi)	15.5	14.6
Line Loss (dB)	1.0	1.0
RX Power Level (dBW)	-152.9	-152.6
Noise Density (dBW/Hz)	-202.6	-202.6
Uplink C/No (dB-Hz)	49.7	50.0
Downlink Frequency (MHz)	5183	5183
Power Per Carrier (dBW)	-16.5	-16.5
Line Loss (dB)	0.5	0.5
TX Antenna Gain (dBi)	3.0	3.0
EIRP Per Carrier (dBW)	-14.0	-14.0
Miscellaneous Downlink Losses (dB)	1.0	1.0
Path Loss (dB)	177.3	172.8
Power Flux Density (dBW/m^2-4kHz)	-166.5	-161.9
RX Antenna Gain (dBi)	48.4	48.4
Line Loss (dB)	0.5	0.5
RX Power Level (dBW)	-144.3	-139.8
Noise Density (dBW/Hz)	-204.1	-204.1
Downlink C/No (dB-Hz)	59.7	64.2
Code and Adj Beam Noise Factor (numerical)	1.21	1.21
Code Noise Density @ Satellite (dBW/Hz)	-200.0	-199.6
Code Noise C/Io (dB-Hz)	46.2	46.2
Interfering Feeder Link Received Power	-127.3	-122.8
Code Noise Density @ User (dBW/Hz)	-191.3	-186.8
Code Noise C/Io (dB-Hz)	47.0	47.0
Link C/No (dB-Hz)	42.6	42.7
Eb/No (dB)	5.6	5.7
Matched Filter Loss (dB)	1.0	1.0
Demodulator Implementation Loss (dB)	0.25	0.25
Required Eb/No (dB)	2.8	2.8
Margin (dB)	1.5	1.6

Table C-3. Constellation Link Performance With Equal Power Feeder Link Interference

requirements at either the gateways or on board the satellites. This is no longer the case if Constellation's feeder links have to be operated at Ka-band.

4.1 Link Margins and Diversity Earth Stations

The primary disadvantage of operating at Ka-Band result from the rain impairments experienced at these higher frequencies. Rain attenuation is negligible at C-Band, but it becomes a significant factor that must to be included in the link budgets for Ka-Band systems.

Constellation has assigned an objective of 99.99% for feeder link path availability. To achieve this availability at Ka-band, the radio link has to be capable of handling rain attenuations of 26-78 dB at 20 GHz and 50-140 dB at 30 GHz depending on the actual gateway earth station site in the United States. An additional impairment of rain besides path attenuation is the degradation in system performance due to an increase in antenna thermal temperature. This can be as much as 100 K relative to clear sky temperature with the limit of the antenna noise temperature being between 270 and 290 K which would occur during very high rain rates.

It is impractical to provide the large link margins of this order of magnitude simply by increasing transmitter power and/or antenna gain. An alternative approach to increasing availability is the use of path diversity. Path diversity requires two gateway earth station sites with the traffic to a satellite being switched from one site to the other during high rain attenuation periods. If one site is experiencing severe rain attenuation, then the other site is used. Path diversity is effective since high levels of rain usually occurs in geographically localized cells. It requires separation distances between the two gateway earth station sites ranging from 5 to 30 km.

The further the separation, the greater the diversity improvement. Separation distances above 30 km give little diversity improvement. Dual diversity can decrease outage times by as much as 100. With earth station diversity, the required additional link margins needed to overcome rain attenuation are reduced to about 5 dB at 20 GHz and 10 dB at 30 GHz.

However, this requirement for two separate earth stations significantly impacts the costs associated with a LEO system because it requires twice the number of expensive tracking antennas. The cost impact is more than a factor of two because the Ka-band antennas are more expensive and because it becomes necessary to construct a ground communications system interconnecting the two earth station sites.

Rain induced attenuation also complicates the power control necessary to effectively operate a CDMA systems. Power control is used to accommodate variations in L and S-band signal levels due to subscriber unit blockage and shadowing. On the inbound route, additional satellite transmitter power has to be provided in the Ka-band downlink to provide the fixed margin needed to overcome the additional expected rain attenuation path loss. On the outbound link, the gateway earth station must be able to effectively compensate for attenuation in the CDMA signals due to the instantaneous rain attenuation level being encountered on the radio path between that gateway and the LEO satellite. In a CDMA system, it is necessary that the signal level received at the satellite be at the specified level to avoid having one gateway signal being disadvantaged relative to other gateway signals at the satellite transponder. Since the instantaneous rain attenuation will be different for each gateway-satellite path, the LEO satellites will have to carry a 30 GHz beacon so that each gateway earth station can adjust its uplink power on a closed-loop-power-control-basis to insure that the signal level received at the satellite is at the proper level.

4.2 System Design Impact

Example link budgets have been prepared to illustrate the impact of moving Constellation's feeder links from C to Ka Band. The rain attenuation term of 10 dB is added in the miscellaneous uplink loss entry and 5 dB is added to the miscellaneous downlink loss entry. Two cases are illustrated. In the first case, illustrated in Table C-4, the gateway antenna size is reduced to maintain the same antenna beamwidth and gain as at C-Band so that no increased satellite tracking accuracy is required and the transmit powers are increased to the point necessary to just achieve the same link margins provided in the reference C-Band link budget. In this case the power per carrier required at the gateway earth station increases by 38.8 dB and the power per carrier required in the satellite downlink increases by 14.3 dB. In the second case, illustrated in Table C-5, the antenna size is maintained the same as at C-Band resulting in higher gains but requiring a substantial increase in satellite tracking accuracy due to decreased beamwidth, and the transmit powers are again increased to the point necessary to just achieve the same link margins provided in the reference C-Band link budget. In this case the power per carrier required at the gateway earth station increases by 1.8 dB and the power per carrier required in the satellite downlink increases by 5.3 dB.

Outbound Link Performance

Elevation Angle (°)	25	90
Range (km)	3368	2000
Uplink Frequency (MHz)	28750	28750
Transmit Power Per Carrier (watts)	39.0	39.0
Line Loss (dB)	0.5	0.5
TX Antenna Gain (dBi)	50.4	50.4
Transmit EIRP (dBW)	65.8	65.8
Misc. Uplink Losses (dB)	11.0	11.0
Path Loss (dB)	192.2	187.6
RX Antenna Gain (dBi)	3.0	3.0
Line Loss (dB)	0.5	0.5
RX Power Level (dBW)	-134.8	-130.3
Noise Density (dBW/Hz)	-202.6	-202.6
Uplink C/No (dB-Hz)	67.7	72.3
Downlink Frequency (MHz)	2492	2492
Power per carrier (dBW)	-3.9	-7.1
Line Loss (dB)	1.5	1.5
TX Antenna Gain (dBi)	15.9	14.6
Carrier EIRP (dBW)	10.5	6.0
Miscellaneous Downlink Losses (dB)	0.5	0.5
Path Loss (dB)	170.9	166.4
Power Flux Density (dBW/m^2-4kHz)	-142.0	-142.0
RX Antenna Gain (dBi)	3.0	3.5
Line Loss (dB)	0.5	0.5
RX Power Level (dBW)	-158.4	-157.9
Noise Density (dBW/Hz)	-203.5	-203.5
Downlink C/No (dB-Hz)	45.0	45.6
Code and Adj Beam Noise Factor (numerical)	0.21	0.21
Code Noise Density @ User (dBW/Hz)	-205.5	-205.0
Code Noise C/Io (dB-Hz)	53.9	53.9
Link C/No (dB-Hz)	44.5	45.0
Eb/No (dB)	7.5	8.0
Matched Filter Loss (dB)	1.0	1.0
Demodulator Implementation Loss (dB)	0.25	0.25
Required Eb/No (dB)	2.8	2.8
Margin (dB)	3.5	3.9

Inbound Link Performance

Elevation Angle (°)	25	90
Range (km)	3368	2000
Uplink Frequency (MHz)	1618	1618
Transmit Power Per Carrier (mw)	600.0	250.0
Line Loss (dB)	0.5	0.5
TX Antenna Gain (dBi)	3.0	3.5
Transmit EIRP (dBW)	0.3	-3.0
Misc. Uplink Losses (dB)	0.5	0.5
Path Loss (dB)	167.2	162.7
RX Antenna Gain (dBi)	15.5	14.6
Line Loss (dB)	1.0	1.0
RX Power Level (dBW)	-152.9	-152.6
Noise Density (dBW/Hz)	-202.6	-202.6
Uplink C/No (dB-Hz)	49.7	50.0
Downlink Frequency (MHz)	18950	18950
Power Per Carrier (dBW)	-0.2	-0.2
Line Loss (dB)	0.5	0.5
TX Antenna Gain (dBi)	3.0	3.0
EIRP Per Carrier (dBW)	2.3	2.3
Miscellaneous Downlink Losses (dB)	6.0	6.0
Path Loss (dB)	188.5	184.0
Power Flux Density (dBW/m^2-4kHz)	-150.2	-145.7
RX Antenna Gain (dBi)	48.4	48.4
Line Loss (dB)	0.5	0.5
RX Power Level (dBW)	-144.4	-139.9
Noise Density (dBW/Hz)	-204.1	-204.1
Downlink C/No (dB-Hz)	59.7	64.2
Code and Adj Beam Noise Factor (numerical)	1.21	1.21
Code Noise Density @ Satellite (dBW/Hz)	-200.0	-199.6
Code Noise C/Io (dB-Hz)	46.2	46.2
Link C/No (dB-Hz)	44.5	44.7
Eb/No (dB)	7.5	7.7
Matched Filter Loss (dB)	1.0	1.0
Demodulator Implementation Loss (dB)	0.25	0.25
Required Eb/No (dB)	2.8	2.8
Margin (dB)	3.5	3.6

Table C-4. Link Performance With Ka-Band Gateway Antenna Gain Same As C-Band Gain

Outbound Link Performance		
Elevation Angle (°)	25	90
Range (km)	3368	2000
Uplink Frequency (MHz)	28750	28750
Transmit Power Per Carrier (watts)	2.0	2.0
Line Loss (dB)	0.5	0.5
TX Antenna Gain (dBi)	63.3	63.3
Transmit EIRP (dBW)	65.8	65.8
Misc. Uplink Losses (dB)	11.0	11.0
Path Loss (dB)	192.2	187.6
RX Antenna Gain (dBi)	3.0	3.0
Line Loss (dB)	0.5	0.5
RX Power Level (dBW)	-134.9	-130.4
Noise Density (dBW/Hz)	-202.6	-202.6
Uplink C/No (dB-Hz)	67.7	72.2
Downlink Frequency (MHz)	2492	2492
Power per carrier (dBW)	-3.9	-7.1
Line Loss (dB)	1.5	1.5
TX Antenna Gain (dBi)	15.9	14.6
Carrier EIRP (dBW)	10.5	6.0
Miscellaneous Downlink Losses (dB)	0.5	0.5
Path Loss (dB)	170.9	166.4
Power Flux Density (dBW/m^2-4kHz)	-142.0	-142.0
RX Antenna Gain (dBi)	3.0	3.5
Line Loss (dB)	0.5	0.5
RX Power Level (dBW)	-158.4	-157.9
Noise Density (dBW/Hz)	-203.5	-203.5
Downlink C/No (dB-Hz)	45.0	45.6
Code and Adj Beam Noise Factor (numerical)	0.21	0.21
Code Noise Density @ User (dBW/Hz)	-205.5	-205.0
Code Noise C/Io (dB-Hz)	53.9	53.9
Link C/No (dB-Hz)	44.5	45.0
Eb/No (dB)	7.5	8.0
Matched Filter Loss (dB)	1.0	1.0
Demodulator Implementation Loss (dB)	0.25	0.25
Required Eb/No (dB)	2.8	2.8
Margin (dB)	3.5	3.9

Inbound Link Performance		
Elevation Angle (°)	25	90
Range (km)	3368	2000
Uplink Frequency (MHz)	1618	1618
Transmit Power Per Carrier (mw)	600.0	250.0
Line Loss (dB)	0.5	0.5
TX Antenna Gain (dBi)	3.0	3.5
Transmit EIRP (dBW)	0.3	-3.0
Misc. Uplink Losses (dB)	0.5	0.5
Path Loss (dB)	167.2	162.7
RX Antenna Gain (dBi)	15.5	14.6
Line Loss (dB)	1.0	1.0
RX Power Level (dBW)	-152.9	-152.6
Noise Density (dBW/Hz)	-202.6	-202.6
Uplink C/No (dB-Hz)	49.7	50.0
Downlink Frequency (MHz)	18950	18950
Power Per Carrier (dBW)	-11.2	-11.2
Line Loss (dB)	0.5	0.5
TX Antenna Gain (dBi)	3.0	3.0
EIRP Per Carrier (dBW)	-8.7	-8.7
Miscellaneous Downlink Losses (dB)	6.0	6.0
Path Loss (dB)	188.5	184.0
Power Flux Density (dBW/m^2-4kHz)	-161.2	-156.7
RX Antenna Gain (dBi)	59.7	59.7
Line Loss (dB)	0.5	0.5
RX Power Level (dBW)	-144.1	-139.6
Noise Density (dBW/Hz)	-204.1	-204.1
Downlink C/No (dB-Hz)	59.9	64.5
Code and Adj Beam Noise Factor (numerical)	1.21	1.21
Code Noise Density @ Satellite (dBW/Hz)	-200.0	-199.6
Code Noise C/Io (dB-Hz)	46.2	46.2
Link C/No (dB-Hz)	44.5	44.7
Eb/No (dB)	7.5	7.7
Matched Filter Loss (dB)	1.0	1.0
Demodulator Implementation Loss (dB)	0.25	0.25
Required Eb/No (dB)	2.8	2.8
Margin (dB)	3.5	3.6

Table C-5. Link Performance With Ka-Band Gateway Antenna Diameter Same As C-Band Diameter

4. Alternative Feeder Link Bands

The Commission indicated in its Notice that the 5150-5216 MHz band may not be available for LEO C-band feeder downlinks in the United States. The NRM Final Report recommended in Section 4.3 that "[i]f this band is not available, the Commission should identify at least one other downlink band between 3 and 15 GHz that would be available for assignment for non-geostationary satellite feeder links to satisfy the feeder requirements identified."

The band options between 3 and 15 GHz are identified in the NRM Final Report, Annex 3, Section 4.3; in addition, more recent work has identified reverse band operations of the Fixed-Satellite Uplink Allotment Bands as a possibility. From a technical, cost, and operational point of view, any of these alternatives are preferable to the Ka-band for Constellation's feeder links, although C-Band feeder links would avoid the need for diversity gateway earth station sites.

5. Summary and Conclusions

Constellation requested the assignment of frequencies in the current RDSS feeder link bands at 6.5 GHz and 5.1 GHz because of their current allocation status, their favorable propagation properties, and the lack of geostationary satellite operations in these bands. If the 5.1 GHz band is unavailable for Constellation's feeder links, Constellation prefers an alternative feeder link band between 3 and 15 GHz. Utilizing Ka-band frequencies for feeder links will have a severely detrimental cost and operational impact on the Constellation system.

Engineer's Certification

The undersigned hereby certify that they are technically qualified persons responsible for the preparation of the engineering information contained in this Appendix, that they have either prepared or reviewed the information contained herein, and that it is complete and accurate to the best of their knowledge.

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May 5, 1994

D

APPENDIX D

JOINT PROPOSAL

OF

TRW, INC., ELLIPSAT CORPORATION

AND

CONSTELLATION COMMUNICATIONS, INC.

January 5, 1993

MSSAC - 23

BEFORE THE

Federal Communications Commission

WASHINGTON, D.C. 20554

In the Matter of	)	
	)	
Establishment of an Advisory Committee to Negotiate Regulations for the Provision of Mobile Satellite Services in the 1610-1626.5 MHz and 2483.5-2500 MHz Frequency Bands	)))))	CC Docket No. 92-166

To: The Commission

JOINT PROPOSAL

The undersigned applicants, by their attorneys, hereby submit for the Advisory Committee's consideration a set of proposed technical rules (Attachment A) and service rules (Attachment B) that are designed to expedite the implementation of satellite systems providing mobile satellite services ("MSS") and radiodetermination satellite services ("RDSS") in the 1610-1626.5 MHz and 2483.5-2500 MHz frequency bands, and thus facilitate the inauguration of valuable MSS and RDSS services in the United States. The rules proposed in the attachments hereto represent several months of efforts by TRW Inc., Ellipsat Corporation, Constellation Communications, Inc., and Loral Qualcomm Satellite Systems, Inc. Each of the parties believes that the proposed rules they have developed provide a reasonable and pragmatic solution to the issues facing the implementation of the MSS/RDSS service in the subject frequency bands.

The undersigned parties intend to introduce the rules proposed in Attachments A and B at the inaugural meeting of the Advisory Committee in this proceeding on January 6, 1993. Loral Qualcomm Satellite Systems, Inc. participated in the development of the technical rules in Attachment A and supports their consideration and implementation. The undersigned applicants trust that careful and attentive consideration of the proposals contained therein will be given by the Committee, and by the Commission itself.

Respectfully submitted,

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ATTACHMENT A

Proposed Technical Rules

PROPOSED TECHNICAL RULE PROVISIONS FOR THE
MOBILE AND RADIODETERMINATION SATELLITE SERVICE

1. **Replace subsection (25) to Section 25.114(c) with the following:**

(25) Applications for authorizations in the Mobile and Radiodetermination Satellite Service in the 1610-1626.5 MHz and 2483.5-2500 MHz bands shall also provide all information specified in § 25.141.

2. **Modify Section 25.141 of the Commission's Rules to read as follows:**

§ 25.141. Licensing Provisions For The Mobile and Radiodetermination Satellite Service in the 1610-1626.5 MHz and 2483.5-2500 MHz Bands.

(a) Space station application requirements. Each application for a space station license in the Mobile and Radiodetermination Satellite Service in the 1610-1626.5 MHz and/or 2483.5-2500 MHz bands shall describe in detail the proposed Mobile and Radiodetermination Satellite Service satellite system, setting forth all pertinent technical and operational aspects of the system, including its capability for providing radiodetermination service on a geographic basis, and the technical, legal and financial qualifications of the applicant. In particular, each applicant shall include the information specified in Section 25.114, except that applicants for non-geostationary Mobile and Radiodetermination Satellite Service systems, in lieu of providing the information concerning orbital locations requested in Section 25.114(c)(6), shall specify the number of space stations that will comprise its system and their orbital configuration, including the number of planes and their inclinations, altitude(s), argument(s) of perigee, service arc(s), and right ascension of ascending node(s). Applicants must also file information demonstrating compliance with all requirements of this section, specifically including information demonstrating that they will not cause harmful interference to any authorized or licensed Mobile and Radiodetermination Satellite Service system.

(b) User transceivers. Individual user transceivers will not be licensed. Service vendors may file blanket applications for transceiver units using FCC Form 493 and specifying the number of units to be covered by the blanket license. FCC Form 430 should be submitted if not already on file in conjunction with other facilities licensed under this subpart. Each application must show that its user transceiver units will comply with the technical parameters of the satellite system(s) with which the units will communicate.

(c) Permissible communications. Stations in these bands shall provide both mobile and radiodetermination satellite communications services.

(d) Frequency assignment policies. Each satellite system authorized under this section will be assigned the entire allocated frequency bands on a non-exclusive basis. Coordination procedures and power limits as set forth in subsections (e) and (f) below shall be employed to avoid harmful interference with other satellite systems in these bands.

(e) Mobile and Radiodetermination satellite system coordination procedures.

(1) Licensees shall coordinate with other licensees to avoid harmful interference to Mobile and Radiodetermination satellite systems in these bands. During the coordination processes, licensees shall exchange relevant information and interference calculations, subject to appropriate confidentiality arrangements, and shall meet as necessary to negotiate in good faith to resolve potential interference problems. Coordination hereunder shall be a continuous process, taking into account changes in system parameters, traffic configuration, and other relevant factors.

(2) Technical coordination in these bands is based on the equitable allocation of interference noise among systems sharing these bands. A non-spread spectrum system shall not cause a higher level of interference to a spread spectrum system, nor place any more restrictive constraints on the operations of a spread spectrum system, than that imposed by any other single spread spectrum system operating in the bands.

(3) Coordination agreements would typically be based on mutually agreed values of the following parameters of each system operating in the band:

(i) The maximum value of the downlink PFD at any point in the service area per system, averaged over an appropriate period of time. Polarization effects shall be considered when calculating the maximum PFD.

(ii) The maximum aggregate EIRP density simultaneously radiated by all user terminals for a single system within the Continental United States.

(iii) Polarization;

(iv) Frequency plans;

(v) Code structures and associated cross correlation properties;

(vi) Antenna beam patterns; and

(vii) Signal burst structures.

(f) License conditions. All authorization in these bands shall be subject to the following conditions:

(1) The e.i.r.p. density of any earth station transmitter shall not exceed -15 dBW/4 kHz in any portion of the 1610-1626.5 MHz band where satellite-borne electronic aids to air navigation are operated under the provision of RR No. 732 of the international Radio Regulations and operation within this limit shall be deemed to provide the necessary level of interference protection to such systems. Notwithstanding the preceding sentence, the e.i.r.p. density of an earth station transmitter may exceed -15 dBW/4 kHz in exceptional cases, even in a portion of the 1610-1626.5 MHz band where satellite borne electronic aids to air navigation are operated, provided that whatever special measures may be necessary to protect such systems from harmful interference are taken.

(2) Each licensee of transmitting earth stations in the 1610.6-1613.8 MHz band shall coordinate its operations with the designated representative for the radio astronomy service in order to provide adequate protection of radio astronomy observations in this band.

[IN RECOGNITION OF THE FACT THAT UNRESOLVED ISSUES REMAIN REGARDING THE DOMESTIC ALLOCATION FOR BI-DIRECTIONAL OPERATIONS IN THE 1613.8-1626.5 MHz BAND, AND IN THE EVENT THAT THE COMMISSION DECIDES TO ALLOW FOR THE POSSIBILITY OF SUCH SECONDARY, BI-DIRECTIONAL OPERATIONS IN THAT BAND, SUBSECTION (g), AS FOLLOWS, WOULD BE ADDED]

(g) Downlink operations in the 1613.8-1626.5 MHz band. Use of the 1613.8-1626.5 MHz band for space-to-Earth transmission is authorized on a secondary basis as defined in § 2.104(d)(4) and § 2.105(c)(3) of the Commission's Rules. Authorizations to conduct such space-to-Earth transmissions shall be subject to the following conditions:

(1) Any secondary usage of the 1613.8-1626.5 MHz band shall not reduce the capacity of any primary user of the band.

(2) The transmitting space station EIRP density shall be below **(TBD)** for transmissions not impinging on the earth in order to avoid harmful interference into primary uplink services;

(3) The EIRP of the main lobe downlink transmission shall be limited so as to include the effects due to specular reflections from the earth to comply with paragraph (1) of this subsection (g);

(4) Space-to-Earth transmissions in any space station antenna beam shall cease whenever there is a direct line-of-sight coupling with a receiving beam on another satellite in the band;

(5) Receiving earth stations in this band cannot claim protection from harmful interference from, nor otherwise place operating constraints on, transmitting earth stations operating in the band; and

(6) Operation of such downlinks shall cease immediately upon notification of harmful interference being caused to licensed uplink operations in the band.